Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus

For

B. Sc. (Computer Science)

Choice Based Credit System (CBCS) Syllabus
Under National Education Policy (NEP)

To be implemented from Academic Year 2024-2025

SEM I	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Subject 1 T(2)+ (T/P) (2) or T(4)	24CsCmpU1101	Programming in 'C'	2		2		20	30	50
	24CsCmpU1102	Lab Course on 24CsCmpU1101		2		4	20	30	50
Subject 2 T(2)+ (T/P) (2) or T(4)	24CsMatU1201	Discrete Mathematics	2		2		20	30	50
	24CsMatU1202	Lab Course on 24CsMatU1201		2		4	20	30	50
Subject 3 T(2)+ (T/P) (2) or T(4)	24CsEleU1301	Basics of Electronics Components and Circuits	2		2		20	30	50
	24CsEleU1302	Lab course on 24CsEleU1301		2		4	20	30	50
IKS T(2)	24CpCopU1901	Generic IKS	2		2		20	30	50
GE/OE (T/P) (2)	24CsCopU1401	Computer Fundamentals	2		2		20	30	50
SEC (P) (2)	24CsStaU1601	Lab Course on Statistical Analysis using R Programming I		2		4	20	30	50
AEC T(2)	24CpCopU1701 / 24CpCopU1702	MIL-I (Hindi) / MIL-I (Marathi)	2		2		20	30	50
VEC T (2)	24CpCopU1801	Environmental Science	2		2		20	30	50
Total			14	08	14	16			550

SEM II **Course T**	**Course Code**	**Course Title**	**Credits**		**Teaching Scheme Hr/Week**		**Evaluation Scheme and Max Marks**		
			TH	**PR**	**TH**	**PR**	**CE**	**ESE**	**Total**
Subject 1 T(2)+ T/P(2) or T(4)	24CsCmpU2101	Advanced 'C' Programming	2		2		20	30	50
	24CsCmpU2102	Lab Course on 24CsCmpU2101		2		4	20	30	50
Subject 2 T(2)+ P(2)	24CsMatU2201	Matrix Theory	2		2		20	30	50
	24CsMatU2202	Lab Course on 24CsMatU2201		2		4	20	30	50
Subject 3 T(2)+ P(2)	24CsEleU2301	Basics of Electronic Instrumentation	2		2		20	30	50
	24CsEleU2302	Lab course on 24CsEleU2301		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU2401	Digital Marketing	2		2		20	30	50
SEC P(2)	24CsStaU2601	Lab Course on Statistical Analysis using R Programming II		2		4	20	30	50
AEC T(2)	24CpCopU2703	English Communication Skills I	2		2		20	30	50
VEC T(2)	24CpCopU2801	Democracy, Election and Governance	2		2		20	30	50
CC (2)	24CpCopU2001/ 24CpCopU2011/ 24CpCopU2021/ 24CpCopU2031/ 24CpCopU2041/ 24CpCopU2051/ 24CpCopU2061/ 24CpCopU2071	Physical Education/ Cultural Activities/ NSS/ NCC/ Fine Arts/ Applied Arts/ Visual Arts/ Performing Arts	2		2		20	30	50
Total			14	08	14	16			550

Level:- 5.0 (Second Year) Sem:III

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsCmpU3101	Data Structures	2		2		20	30	50
	24CsCmpU3102	DBMS	2		2		20	30	50
	24CsCmpU3103	Lab on 24CsCmpU3101 and 24CsCmpU3102		2		4	20	30	50
VSC P(2)	24CsCmpU3501	Lab on Scripting Languages		2		4	20	30	50
IKS (T/P)(2)	24CsCmpU3901	Vedic Maths and Computer Fundamentals	2		2		20	30	50
FP P(2)	24CsCmpU3002	Field Project I		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24CsMatU3301 / 24CsEleU3301	Maths or Electronics	2		2		20	30	50
	24CsMatU3302/ 24CsEleU3302	Maths or Electronics		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU3401	Cyber Security		2		4	20	30	50
AEC T(2)	24CpCopU3703	English Communication Skills II	2		2		20	30	50
CC T(2)	24CpCopU3001	Online Course on Yoga	2		2		20	30	50
Total			12	10	12	20			550

Level:- 5.0 (Second Year) Sem:IV

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsCmpU4101	Advanced Data Structures	2		2		20	30	50
	24CsCmpU4102	Advanced DBMS	2		2		20	30	50
	24CsCmpU4103	Lab on 24CsCmpU4101 and 24CsCmpU4102		2		4	20	30	50
VSC P(2)	24CsCmpU4501	Lab on OOP using C++		2		4	20	30	50
CEP P(2)	24CsCmpU4003	Community Engagement Project		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24CsMatU4301 / 24CsEleU4301	Maths or Elect	2		2		20	30	50
	24CsMatU4302 / 24CsEleU4302	Maths or Elect		2		4	20	30	50
GE/OE (T/P) (2)	24CsCopU4401	Web Designing		2		4	20	30	50
SEC T(2)	24CsStaU4601	Data Mining	2		2		20	30	50
AEC T(2)	24CpCopU4701 / 24CpCopU4702	MIL-II (Hindi) / MIL-II (Marathi)	2		2		20	30	50
CC T(2)	24CpCopU4001	Health and Wellness	2		2		20	30	50
Total			12	10	12	20			550

Detailed Syllabus

SEM- III

1. 24CsCmpU3101 ***Data Structures***
2. 24CsCmpU3102 ***DBMS***
3. 24CsCmpU3103 ***Lab on DS and DBMS***
4. 24CsCmpU3501 ***VSC – Lab on HTML, CSS***

Elective

5. 24CsMatU3301 ***Advanced Discrete Mathematics***
6. 24CsMatU3302 ***Lab Course on 24CsMatU3301***

OR

7. 24CsEleU3301 **Intel 8051 and Raspberry PI**
8. 24CsEleU3302 **Lab course on Intel 8051 and Raspbery Pi**

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Second Year of B.Sc. (Computer Science)

(2024 NEP Course)

Course Code: 24CsCmpU3101

Course Title: Data Structures

Teaching Scheme: 2 Hours /Week **Credit: 2**

Examination Scheme: CIA: 20 **End-Sem: 30**

Prerequisites: Student must be aware of C Programming.

Objectives:

- Study of various data structures at logical, implementation and application level.

Course Outcome:

- Understand Data Structures and their effective and efficient use in solving complex problems.
- Students will able to improve their problem-solving ability by using data structures.

Course Contents:

Unit 1	**Introduction to Data Structures**	**4 lectures**
	1.1 Data Structure Concept 1.2 Abstract Data Type 1.3 Data Structures in C - Arrays and their implementation - Structure - Union	
Unit 2	**Sorting Algorithms**	**6 lectures**
	2.1 Sorting Algorithms and their efficiency comparison using Big Oh - Bubble Sort - Insertion Sort - Quick Sort - Merge Sort - Counting Sort	
Unit 3	**Searching Algorithms**	**6 lectures**
	3.1 Searching Algorithms and their efficiency comparison using Big Oh 3.2 Sequential /Linear Search 3.3 Binary Search	
Unit 4	**The Stack**	**8 lectures**

	4.1 Definition and Operations 4.2 Implementation using Array 4.3 Applications – Infix to postfix, postfix evaluation, infix to prefix, prefix evaluation, Recursion	
Unit 5	**The Queue**	**8 lectures**
	5.1 Definition and Operations 5.2 Implementation using Array (Linear and Circular) 5.3 **Priority Queue:** Definition and Operations 5.4 Array Implementation	

Reference Books:

1. Data Structures Using C and C++ By Yedidyah Langsam, Moshe J. Augemstein, Aaron M. Tanenbaum
2. Data Structures A Pseudocode Approach with C By Richard F. Gilberg and Behrouz A. Forouzan

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Second Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsCmpU3102
Course Name: Database Management System

Teaching Scheme: TH: 2 Hours/ Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem :30 Marks**

Prerequisites:

- Basic Computer Awareness
- Basic Knowledge of file system, storing data in file system

Course Objectives:

- To understand the fundamental concepts of database.
- To understand user requirements and frame it in data model.
- To understand creations, manipulation and querying of data in databases

Course Outcomes:
On completion of the course, student will be able to–

- Apply linguistic theory like Database Design.
- Design E-R Model for given requirements and convert the same into database tables.
- Solve real world problems using appropriate set, function, and relational models.

Course Contents:

Unit 1	**Introduction of DBMS**	**2 lectures**
	1.1 Introduction to Files, Databases 1.2 File system Vs DBMS 1.3 Describing & Storing data - Data models 1.3.1 Relational Model 1.3.2 Hierarchical Model 1.3.3 Network Model 1.4 Levels of Abstraction in DBMS 1.5 Data Independence 1.6 Structure of DBMS 1.7 Users of DBMS 1.8 Advantages & Disadvantages of DBMS	
Unit 2	**Relational Database Structure**	**2 lectures**

	2.1 Introduction to Attribute, Table, Tuple 2.1.1 Definition of Attribute 2.1.2 Definition of Table (Relation) 2.1.3 Definition of Tuple (Row) 2.2 Types of Attributes 2.2.1 Simple and Composite Attributes 2.2.2 Single-valued and Multi-valued Attributes 2.2.3 Stored and Derived Attributes 2.3 Key Attributes (Primary, Foreign, Candidate, and Super Key) 2.4 Types of Relationships 2.4.1 One-to-One (1:1) Relationship 2.4.2 One-to-Many (1:M) Relationship 2.4.3 Many-to-One (M:1) Relationship 2.4.4 Many-to-Many(M:M) Relationship	
Unit 3	**Conceptual Design (E-R Model)**	**8 lectures**
	3.1 Introduction to E-R model 3.2 Entity-Relationship Diagrams (ERD) 3.2.1 Symbols Used in E-R Diagram 3.2.2 Representing Entities, Attributes, and Relationships 3.2.3 Weak and Strong Entities 3.3 Generalization, Specialization, and Aggregation 3.4 Case Studies	
Unit 4	**Structured Query Language**	**12 lectures**
	4.1 Introduction to SQL 4.2 Data Types in SQL 4.3 DDL (Data Definition Language) Commands with Examples 4.3.1 CREATE Command 4.3.2 ALTER Command 4.3.3 DROP Command 4.4 DML (Data Manipulation Language) Commands with Examples 4.4.1 SELECT Command 4.4.2 INSERT Command 4.4.3 UPDATE Command 4.4.4 DELETE Command 4.5 DCL(Data Control Language) Commands . 4.6 Introduction to SQL queries 4.7 Integrity Constraints (primary key, foreign key, referential integrity, not null constraint, unique constraint & check constraint) 4.8 Aggregate functions 4.9 Intro. to SQL joins.	
Unit 5	Relational Database Design	**6lectures**
	5.1 Introduction to Relational Database Design 5.2 Introduction to Normalization 5.3 Normal Forms (Only Definitions) 5.3.1 First Normal Form (1NF)	

	5.3.2 Second Normal Form (2NF) 5.3.3 Third Normal Form (3NF) 5.4 Decomposition 5.4.1 Definition of Decomposition 5.4.2 Need for Decomposition in Database Design 5.4.3 Types of Decomposition (Lossy, lossless decomposition and Dependency-Preserving)	

References:

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S. Sudarshan Edition : 7th ISBN 9780078022159,Tata McGraw-Hill Education
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw HillScience/Engineering/Math; 3edition,ISBN:9780072465631
3. Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe Edition: 7e Edition (2017) Publisher: Pearson ISBN: 978-9332582705
4. An Introduction to Database Systems by Bipin C. Desai Publisher: Galgotia Publications.
5. PracticalPostgreSQL(B/CD),JohnWorsley,JoshuaDrake, ISBN:9788173663925Shroff/O'reilly Systems

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S.Y. B.Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU3103
Course Name: Lab Course on 24CsCmpU3101 and 24CsCmpU3102

Teaching Scheme: PR: 4 Hours/ Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites

- Student must be aware of 'C' Programming.
- Basic knowledge of file system, storing data in file system
- Basic knowledge of Set operations.

Course Objectives:

- Study of various data structures at logical level.
- To implement various data structures at application level.
- To understand database design.
- To understand user requirements and frame it in data model.
- To understand creations, manipulation and querying of data in databases.

Course Contents:

Sr.No	**List of practical**
1	Write a C program to implement Bubble Sort.
2	Write a C program to implement Insertion Sort.
3	Write a C program to implement Quick Sort.
4	Write a C program to implement Merge Sort.
5	Write a C program to implement linear search.
6	Write a C program to implement binary search (Non-Recursive).
7	Write a C program to implement binary search (Recursive)
8	Write a C program to convert infix expression into postfix form.
9	Write a C program to implement evaluation of postfix.
10	Write a C program to implement Towers=of-hanoi.
11	Write a C program to implement static circular queue.

12	Write a C program to implement priority queue. (Ascending / Descending)
13	Assignment to create simple tables using DDL statements
14	Assignment: Case study To create more than one table, with referential integrity constraint, Primary Key constraint.
15	Assignments to create one or more tables with Check, Not null Constraints, alter table, drop table
16	Assignments to use simple forms of insert/update/delete statements
17	Assignment to query the tables using simple form of select statement.
18	Assignment to query table, using like, group by, order by clause in SQL
19	Assignment to query table, using aggregate functions.
20	Nested Queries

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Second Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsCmpU3501
Course Name: Lab on Scripting Languages (VSC P)

Teaching Scheme: 4 Hours/Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem :30 Marks**

Prerequisite Courses:

- **Basic knowledge of Design.**

Course Objectives:

- The student should be able to design dynamic web pages using HTML scripting language.
- The student should be able to apply CSS properties suitably to make screen design attractive.

Course Outcomes:

On completion of the course, student will be able to–

- Design dynamic web pages using HTML 5 & CSS.
- Design various Forms, frames etc.

Course Contents: (Practical)

No	Topic
1	Creating simple HTML pages (use of different tags for changing fonts, foreground, and background colors etc.)
2	HTML programming (use of lists, tables, hyperlinks)
3	HTML programming using font , style , superscript, subscript tags.
4	HTML programming using hyperlinks, Use of header, footer, title, image, style, Marquee.
5	HTML programming Using list (ordered, unordered) tags.
6	HTML Programming using table, frames and iframes tags.

7	HTML Programming using Advanced feature of HTML (Using Inline CSS)
8	HTML Programming using Advanced feature of HTML (Using internal CSS and External CSS).
9	HTML Programming using Creation of forms, small case study to create HTML pages using all the above learning techniques.
10	HTML Programming using Creation of Forms layout designing by using div element with CSS property.

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Second Year of B.Sc. (Computer Science)

(2024 Course under NEP 2020)

Course Code: 24CsMatU3301

Course Name: Advanced Discrete Mathematics

Teaching Scheme: TH: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Semester: 30 Marks**

Prerequisites:

- Set, Logic, Permutations, Combinations, Counting principles, Algebra of equations, Properties of integers.

Course Objectives: To study

- Number theoretic problems using division algorithm for integers
- Euler's theorem and Fermat's theorem.
- Congruence relations on the set of integers.
- Permutations and combinations and its properties.
- First and second principle of Mathematical induction
- Posets, Lattices and types of lattices.
- Linear homogeneous recurrence relations.

Course Outcomes:

On completion of the course, student will be able to:-

- Find greatest common divisor of two integers
- Solve problems based on concept of Prime Integers
- Solve problems based on Residue classes.
- Find a remainder when one (relatively large) integer is divided by another (small integer)
- Solve problems based on counting principles.
- Check whether given set is a partially ordered set or not
- Check whether the given set is a lattice or not.
- Formulate a recurrence relation for recursive algorithm of a given real-life situation
- Solve linear homogeneous recurrence relation.

Course Contents:

Chapter 1	**Divisibility of integers**	**10 Hours**

	● Division algorithm. ● Divisibility and its properties ● Primes ● Greatest Common Divisor and Least Common Multiple ● Euclidean algorithm. ● Relatively prime integers, Euclid lemma ● Congruence relation and its properties ● Residue classes modulo n ● Euler's and Fermat's theorems	
Chapter 2	**Counting Principles**	**10 Hours**
	● Basic Counting Principles ● Inclusion-Exclusion Principle. ● The Pigeonhole Principle ● Permutations and Combinations ● Distributions ● Mathematical Inductions	
Chapter 3	**Lattices and Boolean Algebra**	**5 Hours**
	● Poset and its representation ● Lattices ● Types of Lattices ● Boolean Algebra	
Chapter 4	**Recurrence Relations**	**5 Hours**
	● Introduction ● Modeling with Recurrence Relation ● Linear Homogeneous Recurrence Relations with constant coefficients	
	Total No. of Hours	**30**

Reference Books:

1) Discrete Mathematics and its Applications by Kenneth Rosen, Tata McGraw Hill (Seventh edition), 2011.

2) Discrete Mathematical Structures by Kolman, Busby and Ross, PHI Publications, (Sixth edition), 2009.

3) Elements of Discrete Mathematics by C. L. Liu and D. P. Mohapatra, Tata McGraw Hill (fourth edition), 2013.

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Second Year of B.Sc. (Computer Science)

(2024 Course under NEP 2020)

Course Code: 24CsMatU3302

Course Name: Lab Course on 24CsMatU3301

Teaching Scheme: PR: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks End-Semester: 30 Marks

Prerequisites:

- Set, Logic, Permutations, Combinations, Counting principles, Algebra of equations, Properties of integers.

Course Objectives: To study

- Number theoretic problems using division algorithm for integers
- Euler's theorem and Fermat's theorem.
- Congruence relations on the set of integers.
- Permutations and combinations and its properties.
- First and second principle of Mathematical induction
- Posets, Lattices and types of lattices.
- Linear homogeneous recurrence relations.

Course Outcomes:

On completion of the course, student will be able to:-

- Find greatest common divisor of two integers
- Solve problems based on concept of Prime Integers
- Solve problems based on Residue classes.
- Find a remainder when one (relatively large) integer is divided by another (small integer)
- Solve problems based on counting principles.
- Check whether given set is a partially ordered set or not
- Check whether the given set is a lattice or not.
- Formulate a recurrence relation for recursive algorithm of a given real life situation
- Solve linear homogeneous recurrence relation.

Course Contents:

	List of Practicals	**60 Hours**
Practical 1	Divisibility	
Practical 2	Prime Numbers	
Practical 3	Euclidean Algorithm	
Practical 4	Congruence Relation	
Practical 5	Euler's and Fermat's Theorems	
Practical 6	The Pigeonhole Principle	
Practical 7	Permutations and Combinations	
Practical 8	Distributions	
Practical 9	The Inclusion-Exclusion Principle	
Practical 10	Mathematical Induction	
Practical 11	Partially Ordered Sets	
Practical 12	Lattices	
Practical 13	Boolean Algebra	
Practical 14	Modeling with Recurrence Relation	
Practical 15	Linear Homogeneous Recurrence Relations	

Note: For every batch there will be 4 hours for each practical session per week.

Reference Books:

1) Discrete Mathematics and its Applications by Kenneth Rosen, Tata McGraw Hill (Seventh edition), 2011.
2) Discrete Mathematical Structures by Kolman, Busby and Ross, PHI Publications, (Sixth edition), 2009.
3) Elements of Discrete Mathematics by C. L. Liu and D. P. Mohapatra, Tata McGraw Hill (fourth edition), 2013.

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Second Year of B.Sc. (Computer Science) Minor: Electronics
Under Revised NEP2020 (NEP 2024)

SEMESTER III

Course Code: 24CsEleU3302 **Course Name: Intel 8051 and Raspberry PI**

Teaching Scheme: Th: 2hrs. / Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites: Basic knowledge of Digital Electronics and C programming.
Course Objectives: This course will enable the students to:

1. Understand Architecture of Intel8051 and Raspberry PI microcontroller.
2. Learn basics of Assembly, Embedded C and python programming language.
3. Learn interfacing of input &output with Intel 8051 and Raspberry Pi.
4. Learn to develop the embedded system.
5. Understand and apply Python syntax and semantics in program development.

Course Outcomes:

- Understand the architecture and operation of the 8051 and Raspberry Pi microcontrollers.
- Learn assembly and embedded C programming for these microcontrollers.
- Develop interfacing skills for peripherals such as LCD, Keypad, ADC, DAC, motors, and sensors.
- Implement embedded system applications using 8051

Course Contents

Chapter 1	**Introduction to Microcontrollers**	08 hrs
	Architecture & Features :- Intel 8051 architecture, Internal memory organization (RAM, ROM), Special function registers (SFRs), I/O ports and pin configuration, Timers and Counters ,Interrupts. **Assembly language programming**:- Addressing modes, Instruction set, assembler directives(ORG,DB, END),Delay generation using loops and timers, Serial communication.	
Chapter 2	C **Programming for 8051 microcontroller**	8hrs

	Peripheral Interfacing:- LED, Seven-Segment Display, LCD and Keypad, Serial Communication (UART),Timer-based delay generation	
Chapter 3	**Raspberry Pi Fundamentals**	6Hrs
	Introduction: Raspberry Pi, Features of Raspberry Pi, History of Raspberry Pi, Architecture Overview, CPU Overview, CPU Pipeline Stages, Branch Prediction and Folding, Essential Input Output Devices, Setting Up Raspberry Pi, Raspbian OS, Linux commands for Raspberry Pi. GPIO Pins, Configuring GPIO Pins,	
Chapter 4	**Python programming for Raspberry Pi**	8 Hrs
	Python programming on Raspberry Pi platform, modules of Python Raspberry Pi. GPU Overview, Importing Libraries, Python and Hardware Access, **Interfacing**: LED, SSD, Switches, Alphanumeric LCD, ADC, Servo Motor, Stepper Motor with Raspberry Pi. Interfacing different sensors to Raspberry Pi – temperature, pressure, DHT11,PIR sensor, Ultrasonic sensor	

Text/ Reference Books:

1. "The 8051 Microcontroller and Embedded Systems" – Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin McKinlay, Pearson India, 2nd edition.
2. 8051 microcontroller hardware,software and application, B udayshankara,MS milikarjuna swami, McGraw Hill Education India. 1st edition.
3. Programming the Raspberry Pi Getting Started with Python, Simon Monk, McGraw Hill Education India, 3rd edition.
4. Python for Everybody, Dr. Charles R. Severance. https://www.py4e.com/
5. Learn RPI Programming with Python, Wolfram Donat. Technology In Action, 1st edition.
6. Raspberry Pi User Guide by Eben Upton, Greath Halfacree ,John Wiley Publication, 4th Edition.
7. Raspberry Pi CookBook: Software & Hardware problems and Solutions by Simon Monk, O'Reilly publisher, 3rd edition.
8. Python Crash Course: A Hands-On, Project-Based Introduction to Programming, San Francisco : No Starch Press,1st edition.
9. Raspberry Pi Robotic Projects - Machine Learning For Absolute Beginner, Richard Grimmet, Packt publisher,3rd edition.

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Second Year of B.Sc. (Computer Science) Minor: Electronics
Under Revised NEP2020 (NEP 2024)

SEMESTER III

Course Code: 24CsEleU3302 Course Name: Lab course on Intel 8051 and Raspbery Pi

Teaching Scheme: PR: 4 hrs / Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites: Basic knowledge of Digital Electronics and C programming

Course Objectives: This course will enable the students to:

1. Learn basic python programming.
2. Learn interfacing with Raspberry Pi.
3. Learn general input and Output connection.
4. Understand and apply Python syntax and semantics in program development.

Course Outcomes: At the end of the course the student should be able to:

1. Understand the architecture and operation of the 8051 and Raspberry PI.
2. Learn assembly and embedded C programming for these microcontrollers.
3. Develop interfacing skills for peripherals such as LCD, Keypad, ADC, DAC, motors, and sensors.
4. Implement embedded system applications using 8051 and Raspberry PI.
5. Utilize Python & built-in data structures such as lists, tuples, sets, and dictionaries effectively.
6. Setting up the development environment.

Course Contents:(Any 12)

1. Basics of assembly program: basic arithmetic and logical instruction handling Code conversion, Equal length array addition, Array sorting.
2. Study of LED interfacing to 8051 and programme for LED blinking using 8051
3. Study of SSD interfacing and programming using 8051 as rolling display.
4. Study of Interfacing thumb wheel switch and SSD and programming of 8051
5. Study of LCD interfacing and its programming using 8051

6. Create a simple serial communication program to send characters between 8051 and PC.
7. Study of waveform generations using DAC 8051.
8. Study for PWM Generation for speed control of DC motor using PIC
9. Study the Configuration of Raspberian OS.
10. Program to find square root of a number using Python programming.
11. Find prime number using Python programming.
12. Find smallest /largest from array of numbers using Python programming.
13. Program the Raspberry Pi to control light emitting diodes (LEDs) and to get feedback from a switch connected to the GPIO pins.
14. Program the Raspberry Pi to get the temperature from a sensor connected to the GPIO pins.
15. Program the Raspberry Pi to detect room light from a photocell sensor connected to the GPIO pins.
16. Program the Raspberry Pi for Motion detection using Raspberry pi.
17. Program the Raspberry Pi for interfacing the DHT11 sensor.
18. Program the Raspberry Pi for interfacing the Ultrasonic sensor.
19. Program the Raspberry Pi for water level monitor.

Detailed Syllabus
Sem - IV

1. **24CsCmpU4101** ***Advanced Data Structures***
2. **24CsCmpU4102** ***Advanced Database concepts***
3. **24CsCmpU4103** ***Lab on ADS and ADBMS***
4. **24CsCmpU4501** **Lab on OOP using C++ (VSC P)**

Elective

5. **24CsMatU4301** **Groups and Coding Theory**
6. **24CsMatU4302** **Lab Course on 24CsMatU4301**

OR

7. **24CsEleU4301** Analog and Advanced Digital Communication
8. **24CsEleU4302** **Lab Course on 24CsMatU4301**

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune - 5

Second Year of B.Sc. (Computer Science)

(2024 NEP Course)

Course Code: 24CsCmpU4101

Course Title: Advanced Data Structures

Teaching Scheme: TH: **Credit: 2**

Examination Scheme: CIA: 20 Marks **End-Sem : 30 Marks**

Prerequisites:

Student must be aware of Basic Data Structures such as Arrays, Linked List, Stack and Queue

Objectives:

- Study of various complex data structures at logical, implementation and application level.

Course Outcome:

- Understand Data Structures and their effective and efficient use in solving complex problems.
- Students will able to improve their problem-solving ability by using data structures.

Course Contents:

Unit 1	**The Linked List**	**8 lectures**
	1.1 Concept of pointers and dynamic memory allocation 1.2 Definition and Operations 1.3 Singly linear and circular linked list 1.4 Doubly linear and circular linked list 1.5 Implementation of stack and queue using linked list	
Unit 2	**Binary Trees**	**8 lectures**

	2.1 Definition, Concepts and Terminologies, Operations (including inorder, preorder, postorder and bfs) 2.2 Representation of Binary trees using Array and Linked List 2.3 Application of Binary Tree – Binary Search Tree 2.4 Tree sorting - Binary Tree Sort, HeapSort with efficiency comparison	
Unit 3	**Hashing**	**6 lectures**
	3.1 Concept and Terminologies 3.2 Hashing with and without Chaining 3.3 Efficiency considerations	
Unit 4	**Graphs**	**8 lectures**
	4.1 Concept and Terminologies 4.2 Static and Linked Representations 4.3 Operations including Depth First and Breadth First Traversal 4.4 **Applications** – Activity of Vertex(AOV) and Activity on Edges (AOE)	

Reference Books:

1. Data Structures Using C and C++ By Yedidyah Langsam, Moshe J. Augemstein, Aaron M. Tanenbaum.
2. Data Structures A Pseudocode Approach with C By Richard F. Gilberg and Behrouz A. Forouzan

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S.Y. B. Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU4102
Course Name: Advanced Database Concepts

Teaching Scheme: TH: 2 Hours/ Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites

- Basic Knowledge of DBMS
- Knowledge of SQL Queries
- Basics of relational design
- Basics of ER model

Course Objectives

- To introduce fundamental concepts of RDBMS (PL/PgSQL)
- To understand the Database Management activities like transaction processing and concurrency control.
- To understand the importance of database integrity and data security
- To understand crash recovery concepts with its importance
- To introduce different types of databases

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall E-R Model and convert the same into database tables.	1
CO 2	Demonstrate and apply database techniques using PL/pgSQL.	2
CO 3	Apply transaction Management in relational database System.	3
CO 4	Classify different database integrity and security methods.	4

CO 5	Determine crash recovery techniques.	5
CO 6	Elaborate different types of databases.	6

Course Contents

Unit 1	**Relational Database Design Using PLSQL**	**10 lectures**
	1.1 Introduction to PL support in SQL 1.2 Plpgsql: Datatypes, Language structure 1.3 Conditional statements, loops 1.4 View structure and its usage 1.5 Stored Functions 1.6 Handling Errors and Exceptions 1.7 Introduction to Cursors 1.8 Introduction to Triggers	
Unit 2	**Concepts of Transaction, Concurrency control**	**8 lectures**
	2.1 Describe a transaction, properties of transaction, state of the transaction. 2.2 Executing transactions concurrently associated problem in concurrent execution. 2.3 Schedules, types of schedules, concept of Serializability, Precedence graph for Serializability. 2.4 Ensuring Serializability by locks, different lock modes, 2PL and its variations. 2.5 Starvation, Deadlock and deadlock handling.	
Unit 3	**Database Integrity and Security Concepts**	**6 lectures**
	3.1 Introduction to database security concepts 3.2 Methods for database security 3.3 Access control method 3.4 Overview of encryption technique or security 3.5 Statistical database security	
Unit 4	**Crash Recovery**	**4 lectures**
	4.1 Failure classification 4.2 Recovery concepts 4.3 Log based recovery techniques (Deferred and Immediate update) 4.4 Checkpoints, Relationship between database manager and buffer cache. 4.5 Recovery with concurrent transactions (Rollback, checkpoints, commit)	

Unit 5	Introduction to Advanced Databases	2 lectures
	5.1 Parallel and distributed Databases 5.2 Object Based Databases 5.3 XML Databases 5.4 NoSQL Database 5.5 Multimedia Databases	

References

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan, ISBN:9780071289597, Tata McGraw-Hill Education
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke,McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
3. Database Systems, Shamkant B. Navathe, RamezElmasri, ISBN:9780132144988, Pearson Higher Education
4. Practical Postgresql , By Joshua D. Drake, John C Worsley, O'Reilly publications
5. An introduction to Database systems, Bipin C Desai, Galgotia Publications
6. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
7. An Introduction to Database Systems", C J Date, Addison-Wesley
8. Database Systems : Concepts, Design and Application", S.K.Singh, Pearson, Education
9. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence: by Pramod J. Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
10. MongoDB: The Definitive Guide , Kristina Chodorow, Michael Dirolf, O'Reilly Publications

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S.Y. B.Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU4103
Course Name: Lab Course on 24CsCmpU4101 and 24CsCmpU4102

Teaching Scheme: PR 4 Hours/ Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites

- Student must be aware of Basic Data Structures such as Arrays, Linked List, Stack and Queue.
- Basic Knowledge of DBMS
- Knowledge of SQL Queries
- Basics of relational design.

Course Objectives:

- Study of various complex data structures at logical level.
- To implement advanced data structures at application level.
- To introduce advanced concepts of RDBMS.
- To implement RDBMS concepts using PostgreSQL.

Course Contents:

Sr.No	**List of practical**
1	Write a C program to implement linked list.
2	Write a C program to implement circular linked list.
3	Write a C program to implement doubly linked list.
4	Write a C program to implement doubly circular linked list.
5	Write a C program to implement stack implementation using linked list.
6	Write a C program to implement queue implementation using linked list.
7	Write a C program to implement Binary search Tree with all traversing operations.
8	Write a C program to implement Binary search Tree to Count number of leaf nodes Count number of non-leaf nodes

9	Write C program to implement Binary Search Tree to Create its mirror Check whether two trees are mirrors
10	Write a C program to implement Hashing (Linear probing)
11	Write a C program to implement Hashing (Separate chaining).
12	Write a C program to implement Graph using adjacency matrix and calculate in-degree and out – degree for each node.
13	Write a C program to convert adjacency matrix to adjacency list.
14	Assignment on Nested Queries using PostgreSQL.
15	Assignment to write views on the given databases.
16	Assignment to write functions on the given databases.
17	Assignment to write functions using exceptions and error handling on the given databases.
18	Assignment to write functions using cursors on the given databases.
19	Assignment to write triggers on the given databases.

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S.Y. B.Sc. (Computer Science)
(2024 Course under NEP)

Course Code: 24CsCmpU4501

Course Name: Lab on OOP using C++ (VSC P)

Teaching Scheme:PR : 4 Hours/Week **Credit : 02**

Examination Scheme: CIA: 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- Knowledge of C Programming Language

Course Objectives:

- Acquire an understanding of basic object-oriented concepts and the issues involved in effective class design
- To learn the syntax and semantics of the **C++** programming language.
- In order to write C++ programs that use object-oriented concepts such as information hiding, constructors, destructors, inheritance etc.

Course Contents:

Sr.No	List of practical
1	Write C++ program using basic concepts of C++.
2	Write C++ program using Class, Object, and Array of objects.
3	Write C++ program using function in C++.
4	Write C++ program using Function Overloading.
5	Write C++ program using Constructors and Destructors.
6	Write C++ program to implement Operator Overloading.
7	Write C++ program to implement Inheritance.
8	Write C++ program to implement Virtual base class.
9	Write C++ program to implement Virtual functions.
10	Write C++ program using File Handling concepts.

11	Write C++ program to implement Exception Handling	Page **32** of
12	Write C++ program to implement Templates.	

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Second Year of B.Sc. (Computer Science)

(2024 Course under NEP 2020)

Course Code: 24CsMatU4301

Course Name: Groups and Coding Theory

Teaching Scheme: TH: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Semester: 30 Marks**

Prerequisites:

- Set theory, Matrix Algebra.

Course Objectives: To study

- Binary operations
- Semigroup and monoid
- Group
- Types of groups
- Coding theory
- Cryptography

Course Outcomes: On completion of the course, student will be able to:-

- Learn binary operations
- Understand group structure
- Solve problems based on types of groups
- Understand encoding and decoding process
- Detect errors in coding and decoding
- Study Public Key Cryptosystem

Course Contents:

Chapter 1	**Introduction to Algebraic Structures**	**6 Hours**
	● Binary Operations ● Semigroup, Monoid ● Group ● Properties of Group	
Chapter 2	**Groups and Subgroups**	**10 Hours**
	● Subgroups ● Cyclic groups ● Abelian groups ● Permutation groups ● Normal subgroups ● Quotient Groups	
Chapter 3	**Coding Theory**	**8 Hours**
	● Coding of Binary information and error detection ● Group Codes, Hamming codes, Polynomial codes, Block codes, Linear codes ● Decoding and Error correction	
Chapter 4	**Cryptography**	**6 Hours**
	● Simple Cryptosystems ● Enciphering Matrices ● The Public key Cryptography: Introduction ● RSA cryptosystem ● Knapsack	
	Total No. of Hours	**30**

Reference Books:

Note: For every batch there will be 4 hours for each practical session per week.

Reference Books:

1) Contemporary Abstract Algebra by Joseph A. Gallian, Narosa Publishing House, Fourth edition
2) Discrete Mathematical Structures by Kolman, Busby and Ross, PHI Publication, Sixth edition
3) A Course in Number Theory and Cryptography by Neal Koblitz, Springer-Verlag Publication
3) Applied Discrete Structures for Computer Science by Alan Doerr and Kenneth Levasseur, Science Research Associates Publications (Paperback edition)
4) https://archive.nptel.ac.in/courses/108/104/108104092/

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Second Year of B.Sc. (Computer Science)
(2024 Course under NEP 2020)

Course Code: 24CsMatU4302
Course Name: Lab Course on 24CsMatU4301
Teaching Scheme: PR: 4 Hours/Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Semester: 30 Marks**

Prerequisites:

- Set theory, Matrix Algebra.

Course Objectives:

To study

- Binary operations
- Semigroup and monoid
- Group
- Types of groups
- Coding theory
- Cryptography

Course Outcomes:

On completion of the course, student will be able to:-

- Learn binary operations
- Understand group structure
- Solve problems based on types of groups
- Understand encoding and decoding process
- Detect errors in coding and decoding
- Study public key Cryptosystem

Course Contents:

	List of Practicals	**60 Hours**
Practical 1	Binary Operations	
Practical 2	Semigroups and Monoids	
Practical 3	Groups and Subgroups	
Practical 4	Cyclic groups	
Practical 5	Permutation groups	
Practical 6	Quotient Groups	
Practical 7	Group theory using **GAP** software	
Practical 8	Group and Hamming Codes	
Practical 9	Polynomial, Block and Linear Codes	
Practical 10	Detection of errors	
Practical 11	Correction of errors	
Practical 12	Public Key Cryptography	
Practical 13	RSA Cryptosystem and Digital Signature	
Practical 14	Knapsack Cryptosystem	
Practical 15	Coding Theory using **Sage** software	

Note: For every batch there will be 4 hours for each practical session per week.

Reference Books:

1) Contemporary Abstract Algebra by Joseph A. Gallian, Narosa Publishing House, Fourth edition
2) Discrete Mathematical Structures by Kolman, Busby and Ross, PHI Publication, Sixth edition
3) A Course in Number Theory and Cryptography by Neal Koblitz, Springer-Verlag Publication
3) Applied Discrete Structures for Computer Science by Alan Doerr and Kenneth Levasseur, Science Research Associates Publications (Paperback edition)
4) https://archive.nptel.ac.in/courses/108/104/108104092/

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Second Year of B. Sc (Computer Science) Electronics Revised NEP2020 (2024)
SEMESTER IV

Course Code: 24CsEleU4301 **Minor: Theory**
Course Name: Analog and Advanced Digital Communication

Teaching Scheme: Th: 2 Hours/Week **Credit:** 02

Examination Scheme: CIA: 20 Marks **End-Sem :** 30 Marks

Course Objectives

1. To study the basics electronic communication system.
2. To study the different analog modulation types.
3. To study antenna and its parameters.
4. To study different digital modulation types.

Course outcomes on completion of the course, student will get the

1. Ability to understand the basic concepts of digital communication system.
2. Understanding the characteristics of analog and digital communication.
3. Ability to understand of modulators and demodulators.
4. Multiplexing and Demultiplexing concepts in electronic communication system.
5. Understanding antenna and its parameters.
6. Ability to understand mathematical formulation of modulation.

Analog and Advanced Digital Communication		
Unit 1	**Basics of Electronic Communications** Concept of communication, Block diagram of electronic communication system, Types of Electronic communications, Communication concepts- Bandwidth, signal bandwidth, channel bandwidth, channel capacity, relation between channel capacity and bandwidth, Nyquist theorem, signal to noise ratio, Shannon theorem.	**04**
Unit 2	**Modulation and Demodulation** Introduction to concepts of modulation and demodulation, Modulation techniques: Analog modulation: Concept of Amplitude, Phase and Frequency modulation, Detail study of amplitude modulation (working of transistorized amplitude modulator and diode demodulator. Equation of amplitude modulated wave, modulation index and frequency spectrum), Frequency modulation circuit using transistor. Digital modulation: Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Block diagram and working, delta modulation circuit, MODEM - concept of ASK, FSK, BPSK, QPSK, QAM , OFDM and block diagram of MODEM using FSK.	**14**
Unit 3	**Multiplexing and Multiple Access Techniques** Study of multiplexing and multiple access techniques: Space division multiplexing, Time division multiplexing, Frequency Division Multiplexing, Code division multiplexing, Spread spectrum techniques: DSSS, FHSS, Introduction to multiple access and corresponding access types: FDMA, TDMA, and CDMA.	**6**
Unit 4	**Introduction to Wireless Communication** Introduction to wireless communication system. Need of wireless communication Systems. Antenna – Introduction, Need, working Principle, Parameters of antenna: Gain, directivity, Radiation pattern, Beam width, Bandwidth, front to back ratio (FBR). Study of micro strip patch antenna: design and applications. Beam steering application of Antenna.	**6**

Reference Books:

1. Communication Electronics : Principles and Applications. L.E.Frenzel 3rd Edition .
2. Modern Electronic Communication. G.M. Miller 7th Edition .
3. Mobile Communication Jochen Schiller 2nd Edition .
4. Wireless Communications: Principles and Practice Rappaport .
5. Wireless Communications and Networks. William Stallings .